

(No Model.)

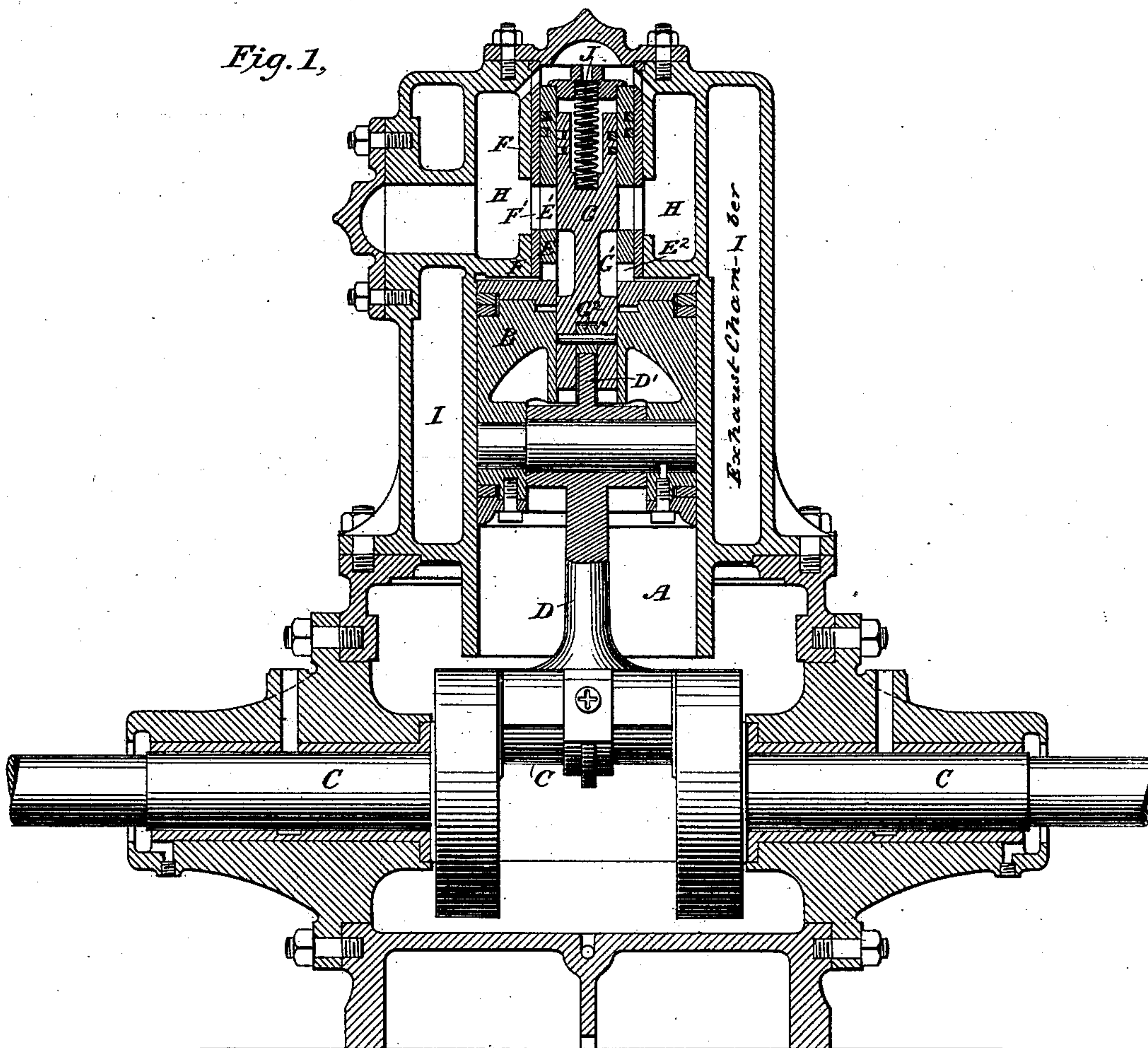
2 Sheets—Sheet 1.

W. LOWRIE.
STEAM ENGINE.

No. 361,169.

Patented Apr. 12, 1887.

Fig. 1,



Witnesses

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 2,

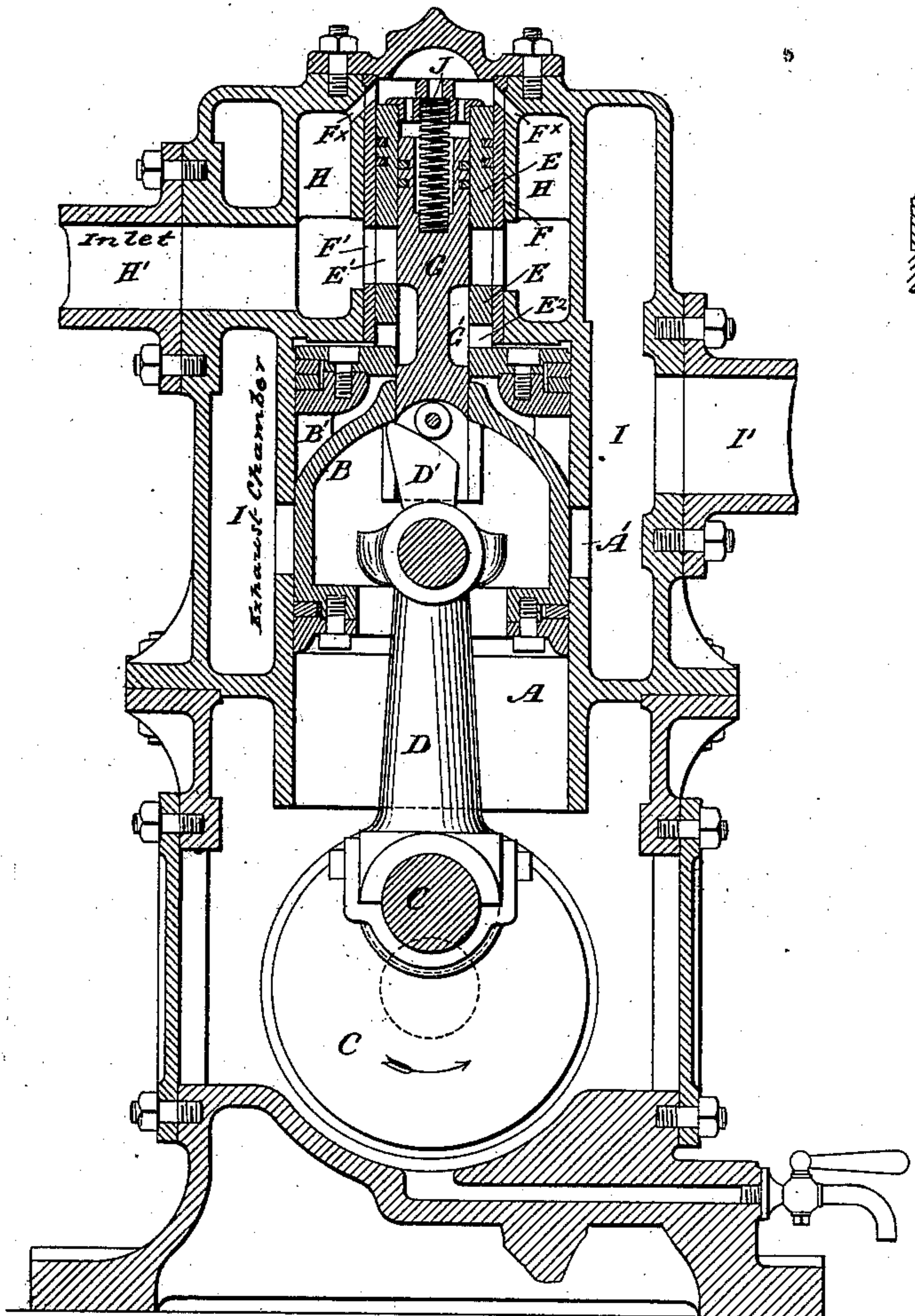


Fig. 3,

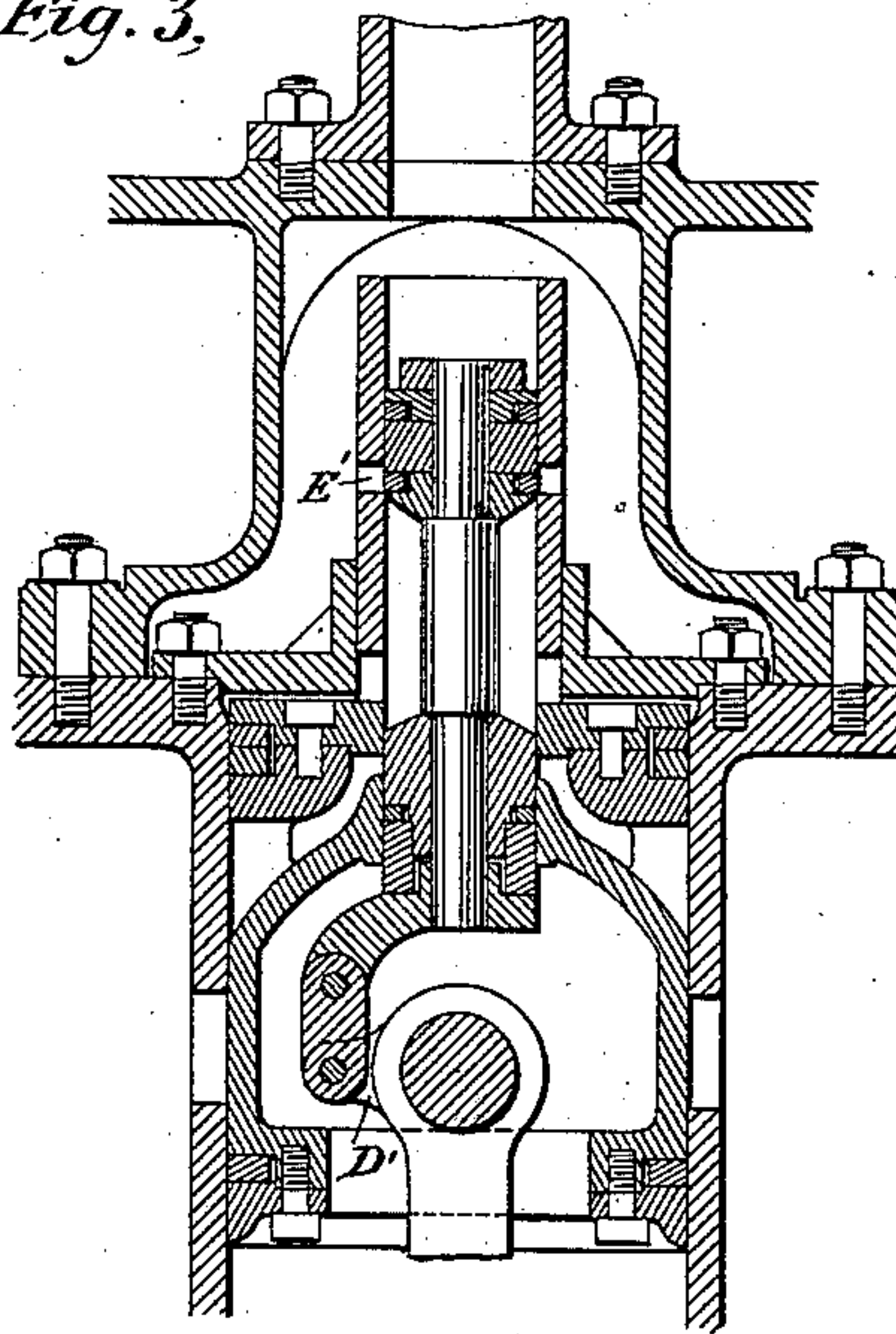
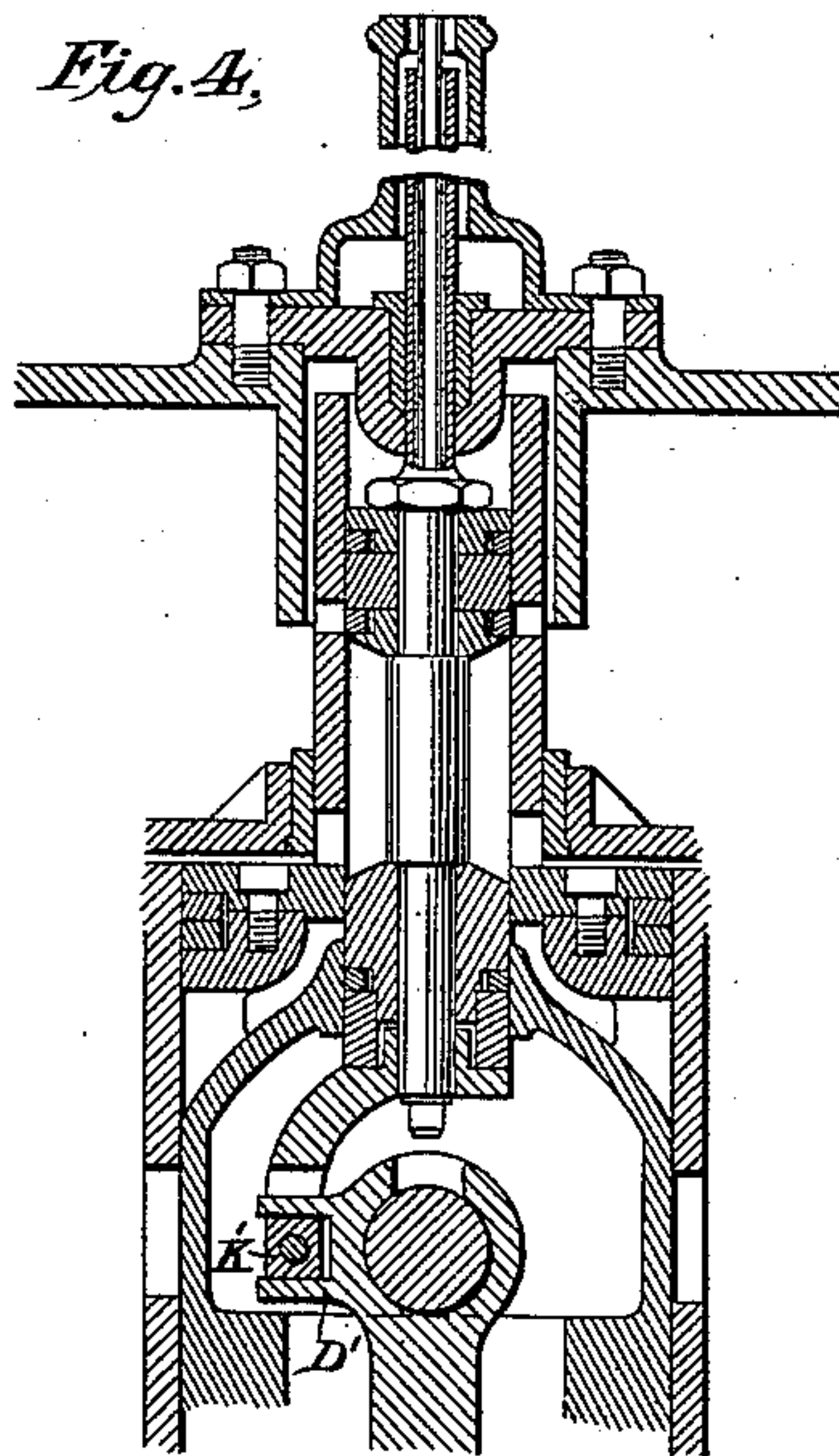


Fig. 4,



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UNITED STATES PATENT OFFICE.

WILLIAM LOWRIE, OF FINSBURY, COUNTY OF MIDDLESEX, ENGLAND.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 361,169, dated April 12, 1887.

Application filed August 6, 1886. Serial No. 210,175. (No model.) Patented in England August 8, 1884, No. 11,077, and in France March 10, 1885, No. 167,532.

To all whom it may concern:

Be it known that I, WILLIAM LOWRIE, a subject of the Queen of Great Britain, residing at Appold Street, Finsbury, in the county of Middlesex, England, have invented certain new and useful Improvements in Steam and other Engines, (for which I have obtained English Letters Patent No. 11,077, dated August 8, 1884, and French Patent No. 167,532, of March 10, 1885,) of which the following is a specification.

My invention relates to that class of steam or other engines denominated "single acting," in which the power is applied to one side of the piston only, the return-stroke being made by the crank. The admission of steam to the cylinder is effected through a hollow extension of the piston. The admission is controlled by a valve working within said hollow extension, and the movements of the valve are caused by the angular motion of the connecting-rod. Steam from the boiler is admitted to a steam-chest surrounding the hollow extension of the piston, and it is also admitted to a space above such extension, so that the piston and connecting-rod are always pressed against the crank-pin, which is a matter of importance in engines of this class designed for quick running. The hollow extension of the piston forms in itself a slide-valve, and is called herein the "outer slide-valve," while the valve working therein is called the "inner slide-valve."

To exhaust steam from the cylinder at the end of its forward stroke, I make the piston at the end of the stroke to pass beyond the end of exhaust-ports formed through the sides of the cylinder into an exhaust-chamber. Through these the greater part of the steam in the cylinder will be exhausted. The angular motion of the connecting-rod at the end of the stroke can also be made to move the inner slide-valve, so as to put the ports in the outer slide-valve, which are open to the interior of the cylinder, into communication with ports at the ends of passages which are formed through the piston, and which lead to other ports or openings formed at the sides of the piston opposite to the exhaust-ports in the sides of the cylinder, so as to give a connection with the

exhaust during the whole of the return-stroke, or nearly so.

The action of the valve is as follows: At the completion of the back-stroke of the piston, the inner slide-valve will be moved endwise by the angular motion of the connecting-rod, so as to bring it into position to allow steam to pass from the steam-chamber to the cylinder. After the completion, say, of about one-third of the stroke, the outer slide will, by the movement of the piston, be moved into a position to cut off all passage of steam from the steam-chamber to the cylinder, and this cut-off will be effected very rapidly. At the completion of the stroke the exhaust will take place, as above described.

Any desired number of cylinders may be set at equal angles around the crank-shaft, and the connecting-rods from their pistons all be made to work upon one crank-pin; or a number of cylinders may be ranged in a line and made to work onto separate cranks at equal angles to one another.

Figure 1 of the drawings hereunto annexed shows a longitudinal vertical section, and Fig. 2 a transverse vertical section, of a single-cylinder engine constructed as above described. Figs. 3 and 4 are similar vertical sections showing modified forms of the hollow cylindrical extension from the piston and of the inner slide-valve working therein, and also a modified way in which the angular motion of the connecting-rod may be made to give endwise motion to the inner slide-valve.

In Figs. 1, 2, and 3, A is the cylinder of the engine; B, the piston working therein. C is the crank-shaft, and D the connecting-rod.

E is the hollow cylindrical extension from the piston, and which fits at its sides within a cylindrical casing, F, which extends from the back end of the cylinder.

G is the inner slide-valve fitting within the hollow extension E.

G² is a roller at its lower end, which is kept bearing constantly against a cam-projection, D', on the connecting-rod.

H is a steam-chamber surrounding the cylindrical casing F, which extends from the back of the cylinder. Steam is admitted to this chamber through an inlet, H'. (See Fig. 3.)

In the sides of the casing F are ports or openings F', and in the sides of the hollow extension E are two sets of ports, E' E². Around the inner valve, G, is also a recess, G', which
 5 can overlap both sets of these latter ports. This recess can also be brought to overlap the lower set of ports, E², and the inner ends of ports B', formed through the body of the piston B.

10 A' are ports in the sides of the cylinder, opposite to which the outer ends of these ports B' are brought during the greater part of the stroke of the piston. The upper edge of the piston also comes below the upper edge of the
 15 ports A' when the piston is at the bottom end of its stroke. The ports A' through the side of the cylinder open into an exhaust-chamber, I, which surrounds the cylinder, and may also surround the steam-chamber H, as shown.

20 I' is an outlet from the exhaust-chamber I. The exhaust-chamber I and cylinder A are, as shown, carried on the top of a casing, within which the crank of the crank-shaft is inclosed.

F' are openings by which steam is continuously admitted to the upper part of the cylindrical casing F, so as to bear constantly upon the upper end of the tubular piston-rod and the piston-valve which work therein.

30 J is a spiral spring, which also bears down constantly on the top of the piston-valve and keeps it pressing downward against the cam D' at times when the engine is running and steam turned off from the steam-chamber.

The action of the engine is as follows: The crank-shaft of the engine revolves from right to left in the direction of the arrow, Fig. 2. The piston is shown at the top of the stroke, and the ports E' in its hollow extension E are open to the ports F', so that steam can enter
 40 them from the steam-chamber. As the piston commences its downstroke, the inner slide-valve will be moved upward within the hollow extension E, and the recess G', which is overlapping the ports E², will commence to

45 overlap also the ports E'. Steam will therefore be admitted to the top of the cylinder through the ports E', cavity G, and ports E². When the piston has completed about a third of its downward stroke, the ports E' in the hollow extension E will, by the downward movement of the piston, have been brought below the ports F', and the further admission of steam to the cylinder will be so cut off. Just before the completion of the downward stroke of the

55 piston, the upper edge of the piston will have passed below the upper edge of the ports A' in the sides of the cylinder A, and will so open the upper part of the cylinder to the exhaust. At the completion of the downward

60 stroke, the inner slide-valve will again have been brought into the same position relatively to the hollow extension E as it occupied when the piston was at the top of its stroke and as it is shown in the drawings, but it will then
 65 be moving downward. Shortly after the commencement of the upstroke the recess in the inner slide-valve, which now overlaps the

ports E², will commence also to overlap the inner ends of the ports B', the outer ends of these ports being at the same time opposite to
 70 the ports A' in the sides of the cylinder, thereby putting the upper end of the cylinder in communication with the exhaust through the ports E², B', and A' just before the upper edge of the piston rises above the ports A',
 75 and thereby closes this direct outlet to the exhaust, and the upper end of the cylinder A remains open to the exhaust almost to the end of the upward stroke, through the ports E², B', and A'. It is not necessary that the tubular casing F should be prolonged up to the top of the steam-chamber H, as shown at Figs. 1 and 2. It is sufficient for it to project upward a distance into the steam-chamber, as shown at Figs. 3 and 4, so that steam may enter the ports E' when they rise above its top, and be cut off from them when they descend below it. In these figures also I have shown the lower end of the inner slide-valve connected by a link with an arm, D', extending
 80 from the connecting-rod, so that the inner slide-valve is moved endwise to and fro by the rocking of this arm, just as in the construction shown at Figs. 1 and 2 it is moved to and fro by the rocking of the cam D'.
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In the modification shown at Fig. 4 the lower end of the inner slide-valve has an arm descending from it and carrying a pin which passes through a square block, K. This block lies in a slot in an arm, D', extending from the connecting-rod, so that the inner slide-valve is moved endwise to and fro by the rocking of the connecting-rod, just as in the constructions previously described.

I claim as my invention—

105 1. The combination, substantially as hereinbefore set forth, of a cylinder for steam or other engines, a piston working therein, a hollow extension from the piston, having ports or openings in its sides, and a valve moved longitudinally within said extension by the angular motion of the connecting-rod for governing the admission of steam to the cylinder.

2. The combination, substantially as hereinbefore set forth, of a cylinder, a piston working therein, a tubular extension of the piston, having ports in its sides, a cylindrical valve working longitudinally within said extension, a connecting-rod, crank, and crank-shaft, and means, substantially as described, for giving motion to said valve by the motion of the connecting-rod, whereby the ports in said extension are alternately opened and closed by said valve.

3. The combination, substantially as hereinbefore set forth, of a cylinder, a piston working therein and having a hollow extension with ports in its sides, through which steam is admitted to said cylinder, a slide-valve working within said extension and alternately opening and closing said ports, a connecting-rod, crank, and crank-shaft, a connection between said connecting-rod and said valve, whereby the angular motion of the said rod causes the to-and-fro motion of said valve, and exhaust-ports in
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the sides of said cylinder beyond which the piston moves at the end of its forward stroke.

4. The combination, substantially as hereinbefore set forth, with the cylinder of a single-acting engine, of a piston having cylindrical extensions with ports in its sides, through which steam is admitted to said cylinder, a slide-valve working within said extension, and means for admitting steam at all times when the engine is working against the end of said extension, whereby the piston is pressed toward the crank-shaft.

5. The combination, substantially as hereinbefore set forth, with the cylinder of a single-acting engine, of a piston having a tubular extension with ports in its sides, through which steam is admitted to the cylinder, a steam-chest surrounding said extension, a slide-valve working within said extension, a connecting-rod having a cam-surface upon the end nearest the cylinder, a pin at the end of said valve resting against said cam-surface, whereby the angular motion of the connecting-rod produces a to-and-fro motion of said valve, and means

for pressing said valve at all times toward said connecting-rod.

6. The combination, substantially as hereinbefore set forth, with the cylinder of a single-acting engine, of a piston having a tubular extension with ports in its sides, a slide-valve working within said extension, a connecting-rod and crank-shaft, means for communicating a to-and-fro motion to said valve by the angular motion of said connecting-rod, exhaust-ports in the side of said cylinder, which are opened when the piston is at the end of its forward stroke, and ports through said piston whereby the exhaust is continued during the return-stroke.

In testimony whereof I have hereunto subscribed my name this 8th day of July, A. D. 1886.

WILLIAM LOWRIE.

Witnesses:

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